

## Properties of Light and Electricity

### 4-5 The student will demonstrate an understanding of the properties of light and electricity. (Physical Science)

#### 4-5.9 Summarize the properties of magnets and electromagnets (including polarity, attraction/repulsion, and strength).

**Taxonomy level:** 2.4-B Understand Conceptual Knowledge

**Previous/Future knowledge:** Students have been introduced to properties of magnets in kindergarten (K-5.1) and in 2<sup>nd</sup> grade (2-5) when they observe magnetism, explain the poles of magnets, compare the effects of magnets, and identify everyday uses of magnets. Students have not been introduced to the concepts of polarity and magnetic strength in previous grades. They will further develop the concept of electromagnets in 6<sup>th</sup> grade (6-5.3) when students will explain how magnetism and electricity are interrelated in electromagnets, generators, and simple electrical motors.

**It is essential for students to know** that an *electromagnet* becomes a magnet when an electric current passes through an insulated wire that is wrapped around an iron core (nail). The properties of magnets and electromagnets can be summarized as follows:

#### *Polarity*

- Magnets and electromagnets have areas on their ends (if bar or horseshoe magnets) or on their tops and bottoms (if ceramic, plastic, or “donut” magnets) that are called *poles*.
- The magnetic pull or attraction is strongest at these poles. Every magnet has a *North* pole and a *South* pole.
- The poles of magnets affect each other in the following ways:
  - *Like poles*
    - If the North pole of one magnet and the North pole of another magnet are brought close to each other, they will move away from each other or repel.
    - The same thing happens if the South pole of one magnet and the South pole of another magnet are brought close to each other.
    - *Like poles repel each other.*
  - *Unlike poles*
    - If the North pole of one magnet and the South pole of another magnet are brought close to each other, they will move toward each other or attract.
    - *Unlike poles attract each other.*

#### *Attraction*

- Magnets and electromagnets *attract* or tend to move toward each other (if unlike poles are near each other) and certain types of metals (mainly iron or steel).
- When iron nails or steel paper clips are held near a magnet, they will move toward or be attracted to the magnet.

#### *Repulsion*

- Magnets and electromagnets can *repel* or move away from each other if their like poles (North-North or South-South) are brought near each other.

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#### *Strength*

- The attractive *strength* of a magnet or electromagnet is greatest at its poles.
- Some magnets have a greater attraction for magnetic materials than others.
- The size of the magnetic attraction of a magnet or electromagnet can be measured by counting the number of objects, for example paper clips that a magnet can pick up.

**It is not essential for students to** draw lines of force or magnetic field diagrams for magnets, although a demonstration might be appropriate so that students can visualize magnetic force. Students do not need to know how to induce magnetism in objects.

#### **Assessment Guidelines:**

The objective of this indicator is to *summarize* properties of magnets and electromagnets; therefore, the primary focus of assessment should be to generalize the major characteristics of magnets and electromagnets. However, appropriate assessments should also require students to *interpret* a diagram of magnets with opposite or like poles together to determine which would have attractive forces and which would have repulsive forces; *identify* locations on a bar magnet for where the greatest magnetic strength would be; or *infer* the poles of two magnets as being alike or different if the forces were attractive or repulsive.